

THURSDAY, JUNE 20, 1895.

THE ATOMIC THEORY AND ITS AUTHOR.

John Dalton and the Rise of Modern Chemistry. By Sir Henry E. Roscoe, D.C.L., LL.D., F.R.S. Century Science Series. Pp. 212. (London: Cassell and Company, Ltd., 1895.)

WE have read through this little book from beginning to end with a great deal of pleasure. It tells the story of a life which has already been told more than once, but it tells it in a pleasant style, while at the same time it is fairly complete and, what is equally important in these days, not too long.

John Dalton was born at Eaglesfield, near Cocker-mouth in Cumberland, in 1766, about September 6; but as no register containing a record of his birth has been found, the exact date is not known. John is supposed to have been the second son of his parents, Joseph and Deborah Dalton, but, for the same reason, this statement cannot now be verified. According to his own account he attended the village schools in the neighbourhood, and was fortunate in attracting the notice of Mr. Elihu Robinson, a Quaker like his parents; but while Joseph Dalton was but a humble hand-loom weaver, Robinson was a man of independent means and considerable scientific ability. Under the influence of Mr. Robinson, John made such progress, especially in mathematics, that at the age of twelve he set up school teaching on his own account. When he was about fifteen he left his native place, in order to join his elder brother Jonathan in the conduct of a school at Kendal. Four years later, in 1785, George Bewley, the proprietor of the school, retired from the management, and John became his brother's partner. A quaint card, reproduced photographically in the book, announced to their friends and the public that youth would be "carefully instructed in English, Latin, Greek, and French, also writing, arithmetic, merchants' accompts, and the mathematics."

All this time John was diligently occupied in self-improvement. His active mind, however, could not be contented with mere acquisition of knowledge, and we find that his first attempts at scientific investigations were made here. Meteorological observations occupied him in the first instance, and the requisite barometers and thermometers were made with his own hands. This was the beginning of the long series of daily observations which were continued without a break until the evening before his death in 1844.

In 1793 Dalton left Kendal for Manchester, having undertaken for the modest stipend of £80 a year to teach mathematics, mechanics, geometry, book-keeping, natural philosophy, and chemistry, and we are told that in 1794 he had twenty-four students in these subjects. In this position of college tutor Dalton remained six years, and then resigned his post in order to obtain time for his researches, supporting himself by private tuition. When he left the college, he lived first in a house in Faulkner Street, then with John Cockbain, a member of the Society of Friends; but, after a time, joined the family of the Rev. William Johns, with whom he remained nearly thirty years. It was here that his most important

original work in physics and chemistry was accomplished, here he brought out his system of chemical philosophy, and here he attained to that celebrity which brought him honours from abroad, as well as the friendship of the most distinguished of his own countrymen.

To the pages of the book we must refer our readers for many of the details of Dalton's subsequent career: how he delivered courses of lectures in Edinburgh and Glasgow (1807), and twice at the Royal Institution in Albemarle Street (1803-4 and 1809-10); how he was made a corresponding member of the French Academy of Sciences (1816), and a Fellow of the Royal Society (1822); how he visited Paris (1822), and subsequently, after the death of Davy, was elected a Foreign Associate of the Academy (1830); how he received honorary degrees from many universities, among the rest, from Oxford (1832); and, finally, was assigned a pension out of the funds of the Civil List by King William the Fourth.

Dalton died on July 27, 1844. Since 1837, when he had a paralytic stroke, his vigour had very seriously declined; and of this decline it is obvious that he was conscious. Old people are usually parsimonious, especially if in their younger days they have been obliged to practise economy. Dalton was no exception to this, and an amusing account, which will not bear condensation, is given of a transaction of his with Dr. Lyon Playfair, in January 1844, only a few months before his death.

Dalton seems to have been a great smoker. In a letter quoted on p. 166, he says (January 10, 1804):

"I was introduced to Mr. Davy, who has rooms adjoining mine in the Royal Institution. He is a very agreeable and intelligent young man, and we have interesting conversations in an evening. The principal failing in his character is that he does not smoke."

Wrapt as he was from early youth in his scientific and philosophical pursuits, it is perhaps not surprising that he should have declared that his head was "too full of triangles, chemical processes, and electrical experiments, &c., to think much of marriage." Nevertheless, it appears that the Quaker philosopher had at least one or two affairs of the heart, and even when past the age of giddy youth he seems to have been accessible to the charm of female beauty; for in a letter in which he describes "the belles of New Bond Street," he admits that he is "more taken up with their faces than their dresses," and ends with the remark, "I do not know how it happens, but I fancy pretty women look well anyhow."

Every one has heard of Dalton's peculiarities of vision. It seems remarkable that he should have grown to manhood without becoming aware of his defect, but it appears that it was not till about the age of six-and-twenty that he found out that his notions of green and red were different from those of other people. This evidently caused him at first a good deal of perplexity, and brought down a certain amount of "chaff," for he writes to his old friend Elihu Robinson, that "the young women tell me they will never suffer me to go into the gallery of the meeting-house with a *green* coat; and I tell them I have no objection to their going in with me in a *crimson* (that is, dark drab) gown." Dalton had a notion that his defect of vision was due to the existence of a coloured medium in one of the humours of the eye. It is almost needless to

say that this was a mistake, and that the fact has now long been recognised that many persons are unable to distinguish red and green, though the true physiological explanation is still unknown.

We must now turn to a brief consideration of the chief subject of Dalton's scientific investigations. In connection with the history of the evolution of the atomic theory, Sir Henry Roscoe has been so fortunate as to make an interesting discovery. Among the "Dalton Papers" in the possession of the Manchester Literary and Philosophical Society, he has found the manuscript notes prepared by Dalton for the course of lectures delivered at the Royal Institution in the winter of 1809-10. In these notes he gives an account of the train of thought which led him to adopt the atomic hypothesis for the explanation of chemical phenomena. Contrary to the commonly received account, which appears to have originated with a statement by Dr. Thomas Thomson in his "History of Chemistry," the atomic theory did not first occur to him during his investigation of olefiant gas and carburetted hydrogen gas. From the newly-discovered manuscript it appears that Dalton's atomistic ideas arose in the course of his study of the atmosphere, and in speculating as to how a mixture of two or more elastic fluids could constitute a homogeneous mass. A reader of his "Chemical Philosophy" would perceive how thoroughly he was imbued with the Newtonian doctrine of particles, and in Henry's "Life" this is clearly pointed out.

By whatever process Dalton arrived at the adoption of the atomic hypothesis, it is certain that his great merit consisted in the application of a commonly accepted (see "Chemical Philosophy," part i. p. 141), but vaguely conceived, notion to the explanation of chemical phenomena. It was "for the development of the chemical theory of definite proportions, usually called the "Atomic Theory," more especially, that he received the first awarded Royal Medal in 1826. This is the point upon which emphasis was particularly placed by the president, Sir Humphry Davy, in presenting the medal.

In the course of reading this little book we have met with only one passage which seems to require correction. The statement (p. 153) that Dalton's "great achievement was that he was the first to introduce the idea of quantity into chemistry" is not only erroneous but is inconsistent with the writer's own text, which on p. 161 contains a reference to the names of Wenzel and Richter.

We shall look forward with pleasure to the other volumes of the series. W. A. T.

HYDRAULIC AND OTHER POWERS.

Hydraulic Motors, Turbines, and Pressure Engines. By G. R. Bodmer, A.M.Inst.C.E. Pp. 540. (London: Whittaker and Co., and George Bell and Sons, 1895.)

Motive Powers and their Practical Selection. By Reginald Bolton, A.M.Inst.C.E. Pp. 250. (London and New York: Longmans, Green, and Co., 1895.)

THE first of these works is a second and enlarged edition of an excellent treatise on a subject seldom dealt with in English text-books. The question of the application of water-power to useful purposes is becoming more and more of importance, and the study of the

design and construction of the necessary machinery naturally follows. Continental engineers are in advance of us in this matter, they having long studied the problem successfully. This difference, however, is rapidly disappearing, and will be greatly assisted by the issue of this work.

The author has consulted to a greater or less extent many works and publications, and appears to have brought together much valuable information; this, combined with his own experience, makes the work an important one. Historical matter has been purposely avoided, as well as descriptions of obsolete forms of motors. The author rather jocularly observes in his preface that he is sure to be criticised, one way or the other, as to the use of mathematics in his work. On the question of the free use of mathematical methods we are entirely of his opinion, viz. that formulæ afford the readiest means of accurately stating facts which in the simplest cases can only be verbally defined in elaborate phraseology. The description of the Niagara Falls installation is concise and to the point. This installation is designed for utilising 10,200 cubic feet of water per second, with an available head of 140 feet, which is equivalent, with an assumed efficiency of turbine of 75 per cent. to about 120,000 horse power. The turbines were designed by Messrs. Faesch and Piccard, of Geneva, and made by the I.P. Morris Company of Philadelphia; each of these wheels is to develop 5000-horse power, with a mean head of 136 feet. Other interesting descriptions of recent installations are added, but we miss an account of the Worcester Electric Lighting Station. This is to be regretted, because the installation is an example of a considerable application of water-power under somewhat adverse conditions. The ground covered in this book, both theoretical and practical, is of considerable extent. The author handles the subject in a sensible manner, and arranges it in such a way that the student can have little difficulty in mastering it. For the engineer who looks for theoretical considerations, there is ample food for reflection. The descriptions of the general theory of various turbines are remarkably clear, and are assisted by diagrams and woodcuts. To those engaged in the design of turbines the volume must be invaluable.

Mr. Bolton's book on "Motive Powers" is of a very different nature, and belongs to that large number of text-books written under the impression that a mere stringing together of "facts, formulæ, and data" is of service to the non-technical reader. The choice of a motor for any particular duty, of course, largely depends on various circumstances, and these must be considered by a qualified engineer. It is questionable whether any amount of study can qualify a non-technical man to make a suitable choice in such a matter. The book, however, contains a large store of information suitable for engineers, and it is arranged in a way that easy reference is possible, which is an important consideration. The author very properly falls foul of the term "nominal horse-power," a useless term, and one very likely to mislead. It is quite time that steam and other engines were sold as representing the available power, or "brake horse-power." Under the head of power defined and compared, the author might have been more explicit in his definition of the relation between "the watt" and the "horse-power"; 746 watts are equal to